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AGRICULTURAL NEWS LETTER

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This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

In addition to reporting results of the investigations of the Company and its subsidiaries, published reports and direct contributions of investigators of agricultural experiment stations and other institutions are given dealing with the Company's products and other subjects of agricultural interest.

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THE OVICIDAL PROPERTIES OF LAURYL RHODANATE SHOWN BY INVESTIGATIONS ON EGG-KILLING WASHES IN ENGLAND

EDITOR'S NOTE:- This paper is reprinted from the Annual Report of the Agricultural and Horticultural Research Station, Long Ashton, Bristol, England, 1935. It will be recognized as a valuable contribution on the subject treated by those engaged in similar investigations. The use of the paper is acknowledged with thanks to the authors and the research station which published it.

By H. G. H. Kearns and H. Martin

In the last account of the investigations of egg-killing washes carried out at this Station, Staniland, Tutin and Walton (8) advanced two hypotheses concerning the action of tar and petroleum oils on insect eggs. The first was that ovicidal action is due to the deposition of a uniform film, relatively non-volatile and rain-resistant, which kills the eggs by a smothering or stifling action. This hypothesis would explain the efficiency of high-boiling petroleum oils in controlling Red Spider, Capsid Bug and Winter Moth. The second hypothesis was that certain types of oil, in particular tar distillates, possess a chemical toxicity to eggs of Aphid and Sucker, eggs which are not susceptible to the physical smothering action of the oil film.

As tar oils, even of a neutral high-boiling character, are inferior to high-boiling petroleum oils in inhibiting egg hatch of Red Spider and of Capsid Bug (1), a single all-round ovicidal wash requires the incorporation of tar oils in petroleum oil. Except on certain varieties of fruit such as currant, the combined tar-petroleum oil wash is effective only at oil concentrations which frequently cause severe bud damage. Fruit growers have accordingly adopted the practice of two separate applications of egg-killing washes: the first containing tar oil for the control of Aphid, Sucker and, in part, Winter Moth; the second containing petroleum oil for the control of Winter Moth, Capsid Bug and, in part, Red Spider.

The purpose of the work to be described in the present article was the discovery of an ovicide effective against aphid and sucker eggs which could be incorporated with safety in the petroleum oil wash, thus giving a single combined wash rendering unnecessary the separate application of a tar distillate wash.

The hypothesis that the eggs of Winter Moth, Capsid Bug and Red Spider are prevented from hatching by the oil film resulting from the application of winter washes provides a satisfactory explanation for the practical observation that the efficiency of the wash is increased if the time of application be delayed until after the true dormant period. Although experiments recorded elsewhere in this Report (pp.37-48) indicate that ovicidal washes applied for the control of Capsid Bug immediately prior to egg hatch may be ineffective, the best time

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of application of the petroleum oil wash is during a period when the growing buds are susceptible to damage by tar oil washes. The tar distillate substitute should therefore be sufficiently non-phytocidal to enable the application of the combined wash at a period later than complete dormancy yet prior to aphid egg hatch.

Of materials known to be toxic to aphid and sucker eggs, 3:5-dinitro-o-cresol and its salts, previously tried by Gimingham, Massee and Tattersfield (3) were not considered suitable because of their high phytocidal properties. More promising appeared the observation of Murphy and Peet (7) that certain aliphatic thiocyanates (rhodanates) possessed ovicidal activity against Citrus Mealy Bug Pseudococcus citri Risso. These investigators did not specify the actual thiocyanates employed but, in an earlier paper (6) they stated that, although the toxicity of the compound was modified by the nature of the organic radical attached to the thiocyanate group, the differences were of degree rather than kind.

EXPERIMENTAL.

Spray Materials Used.

For the preliminary trials the rhodanate derivatives available were of materials compounded as stock emulsions with petroleum oil, placed at our disposal by Imperial Chemical Industries Ltd. and described thus:-

I.C. 72: Emulsion containing approximately 60 per cent. light petroleum oil, the emulsifier being Agral S.R. (10 per cent.) and the remainder water.

I.C. 21: A similar emulsion containing 10 per cent. organic rhodanate A (cetyl rhodanate).

I.C. 24: An emulsion similar to I.C. 72 but containing 5 per cent. organic rhodanate B (lauryl rhodanate).

Following the promising results with I.C. 24, other samples of the lauryl rhodanate were submitted for test. These samples comprised:-

I.C. 96: A stock emulsion containing 60 per cent. Grade E petroleum oil (5) and 5 per cent. lauryl rhodanate.

Lauryl Rhodanate: the thiocyanate of commercial lauryl alcohol of which the predominant constituent is the dodecyl derivative, $C_{12}H_{25}SCN$.

Emulsions containing the latter material were prepared in a number of ways in order to examine the influence of method of compounding upon the ovicidal efficiency of lauryl rhodanate. In one series of trials, the compound was dissolved in a Grade E petroleum oil (P4b) and emulsified by the two-solution oleic acid method (4). Check trials were made of the oil alone when emulsified by this method. In another series the lauryl rhodanate was dissolved in the oleic acid and emulsified by the addition of this solution to a dilute solution of sodium hydroxide.

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For the purpose of comparison, tar distilate washes prepared from two samples of Grade A tar oil (T 10 and T 11) were included, the two-solution oleic acid method being used for the emulsification of the oils.

Analysis of the various oil samples used gave results quoted in Table I. With reference to the various rhodanates full details of suitable analytical methods have not yet been worked out but the preliminary results have confirmed the manufacturers' statements quoted above.

TABLE I.
Analytical Data of Spray Materials Used.

				Tar Oils.	
	I.C.72.	I.C.96.	P4b.	T10.	T11.
Neutral oil, % by weight ..	62.0	59.0	100.0	89.4	90.6
Tar acids, % by weight ..	0.0	0.0	0.0	4.1	4.0
Neutral oil:					
Sp. Gr. (60°F.)	0.883	0.901	0.898	1.063	1.104
Boiling range:					
10% by volume	347	330	348	274	267°C
50% by volume	382	363	378	337	324°C
80% by volume	--	391	394	390	365°C
Unsulphonated residue:					
% by volume	76	69	74	--	--
Dimethyl sulphate:					
% by volume insoluble in..	100	100	100	0	0

Analyses by methods described by Martin (5).

Laboratory Trials.

The laboratory biological examination of certain of the organic rhodanates as winter ovicides necessitated comparative tests with materials of known toxicity to the test material.

The test insects used were the eggs of Permanent Apple Aphid (Anuraphis pomi De Geer.) and Apple Sucker (Psyllia mali Schmidb.). Preliminary and confirmatory tests were carried out with the aphid over two seasons, and preliminary trials only with the sucker. The Permanent Apple Aphid was selected in preference to the other species on account of the greater ease of rearing the large stocks of uniform material essential for comparable tests. Tar oils of suitable concentrations are highly toxic to the eggs of Permanent Apple Aphid and Sucker, and field experience showed that the eggs of the various species of Apple Aphid exhibit susceptibilities of the same order to such tar oils.

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The eggs were treated with two concentrations of the tar oil in the preliminary tests (Table II) in order to ascertain the concentrations required to give a high and low kill of the eggs. From these results the concentration was adjusted to give a high and moderate egg kill in the confirmatory trials. Similar tests were made with the rhodanates.

The ovicidal properties of the oil, lauryl rhodanate and oil plus lauryl rhodanate were separately ascertained, as it was known that the petroleum oil by itself provided some control of aphid eggs.

(a) Experiments with Aphides. Shoots bearing eggs were cut during dry weather and taken to the laboratory for treatment. The shoots were carefully selected so that each had several hundred eggs of normal and uniform appearance. Not less than 4 shoots were used for each individual test and they were dipped into the insecticide, care being taken to agitate the fluid so that any air film on the shoots or around the eggs was broken. The shoots remained in the fluid for 15 seconds. After treatment they were attached to a strip of wood which was moved in such a manner to avoid the formation of areas of high concentration of the wash during drying. The basal ends of the dried shoots were cut off and rejected and the clean ends thrust into pots filled with damp sand. The pots were allowed to remain out of doors, exposed to the weather, until the first few eggs on the untreated controls showed signs of hatching, which usually occurred 4-10 days after the outer egg membrane had split longitudinally. The shoots were then taken into the laboratory and 8 samples of each treatment (lengths of $1\frac{1}{2}$-$2\frac{1}{2}$ in.) were cut at random.

Each of these lengths was impaled on a pin held by a cork and inserted into an open-ended tube of 5 x 5/8ths inch dimension. The open end was plugged with cotton wool. The twigs during the above sampling were manipulated in such a manner that none of the eggs were damaged or subjected to pressure. The tubes were arranged in trays to facilitate inspection.

The hatched nymphs in most cases wandered from the pieces of shoot and in due course died in the tube. The cotton wool plug permitted the shoot and aphides to dry out without decomposition or development of moulds.

The total number of eggs on each shoot was counted after removal by gently heating the shoot in 10% caustic soda in a water bath for about 10 minutes. Care was taken to avoid decomposition of the bark by excess heating. The eggs were filtered off and washed with weak acid solution and counted in 5 inch petri dishes over squared paper. The aphides were readily counted by shaking and brushing into a petri dish. On each piece of shoot there was not less than 100 eggs and in most cases there were 300.

In the preliminary trials (see Table II) the stock of aphid eggs was obtained from the new wood on an apple stool bed. The bed was carefully sprayed in August to remove all species of Hemiptera. The shoots were then infested with colonies of Permanent Apple Aphid, which bred very rapidly on the vigorous new growth and laid numerous eggs during October.

Continued on next page

In the confirmatory trials (see Table III) the stool bed material failed, due to unfavourable climatic conditions, and material was therefore collected from a number of nursery trees of the variety Worcester Pearmain, considerable care being taken to collect uniform material.

In both seasons the treatments were carried out during the last week of January; hatching began at the end of March and was completed by mid-April. The majority of the eggs hatched during the first week of April.

Parasitism of the eggs was not observed during the two seasons experiments. Observations were made on the influence of the condition of the shoot on the viability of the eggs. It was found that eggs laid on weak shoots and stools, or on shoots covered with apple scab pustules were frequently of low viability. In the experiments care was taken to eliminate shoots of this type.

A high ovicidal efficiency of lauryl rhodanate against the eggs of A. pomi is apparent from Tables II and III. Further it will be noted that neither the addition of petroleum oil nor the various methods of compounding the washes have decreased this efficiency. In both preliminary and confirmatory trials, the cetyl derivative (Rhodanate A) proved less ovicidal than lauryl rhodanate, a result which is in agreement with the general conclusions of Bousquet, Salzberg and Dietz (2). These investigators examined the contact insecticidal action of the alkyl rhodanates upon the active stages of various species of aphides, thrips, and red spider and showed that, of the even-carbon homologues of the normal primary alkyl rhodanates, a toxicity peak occurs at the C_{12} (lauryl) derivative.

(b) Experiments with Apple Sucker. The sucker eggs were laid principally on old wood and a technique was evolved for handling them under laboratory conditions. The preliminary observations revealed the high toxicity of lauryl rhodanate-petroleum oil combinations at concentrations effective against aphid.

Field Trials.

A preliminary field trial was carried out on two blocks of apple trees, each of 60 nursery trees of the variety Worcester Pearmain. A lauryl rhodanate-petroleum oil combination (I.C.96) applied at concentrations of 0.4 lauryl rhodanate and 5.0 per cent. oil on 21st February provided a high degree of control of aphides. No evidence of bud or bark damage was observed.

SUMMARY OF RESULTS.

1. Lauryl rhodanate, in two seasons' laboratory tests, has proved highly toxic to eggs of Anuraphis pomi, being more ovicidal at concentrations of the order of 0.4 per cent. than high-boiling neutral tar oil at 2.0 per cent.

2. The ovicidal efficiency of lauryl rhodanate is unimpaired by solution in petroleum oil and by emulsification with Agral S.R. or by the two-solution oleic acid method.

3. Preliminary trials have indicated that lauryl rhodanate is toxic to eggs of Psyllia mali at concentrations effective against aphid eggs.

4. A preliminary field trial of the combined lauryl rhodanate-petroleum wash has confirmed the general ovicidal efficiency of the wash and has demonstrated that it caused no injury to the sprayed trees.

TABLE II.

PRELIMINARY LABORATORY TRIALS ON A. pomi.

Preparation.	Active constituent and concentration in wash applied.	Emulsifier.	Total number of eggs counted.	Per cent. hatched eggs.
I.C. 21	Rhodanate A 0.8% Petroleum oil (I.C. 72) 4.2%	Agral S.R.	2012	17.3 ± 8.32
I.C. 24	Rhodanate B 0.4% Petroleum oil (I.C. 72) 4.6%	do.	1185	1.1 ± 0.62
I.C. 72	Petroleum oil (I.C. 72)	do.	1524	35.4 ± 5.53
- -	Tar oil (T.10) 2%	Oleic acid (0.6%) Sodium hydroxide (0.1%)	1545	9.5 ± 4.52
- -	Tar oil (T.10) 1%	do.	3313	44.6 ± 4.49
- -	Nil	do.	1876 1378	54.3 ± 8.52 40.7 ± 5.17
- -	Nil	Nil	1423	53.8 ± 5.39

TABLE III.

CONFIRMATORY LABORATORY TRIALS ON *A. pomi.*

Preparation.	Active constituent and concentration in wash applied.	Emulsifier.	Total number of eggs counted.	Per cent. hatched eggs.
I.C. 21	Rhodanate A 0.4% Petroleum oil (I.C. 72) 2.1%	Agral S.R.	2222	15.8 ± 3.76
I.C. 24	Rhodanate B 0.4% Petroleum oil (I.C. 72) 4.6%	do.	1620	0.6 ± 0.22
I.C. 72	Petroleum oil (I.C. 72) 5.0%	do.	2334	31.9 ± 5.03
- -	Lauryl rhodanate 0.4% Petroleum oil (P4b) 5.0%	Oleic acid (0.6%) Sodium hydroxide (0.1%)	1961	0
- -	Lauryl rhodanate 0.2% Petroleum oil (P4b) 5.0%	do.	1797	11.5 ± 3.13
- -	Lauryl rhodanate 0.05% Petroleum oil (P4b) 5.0%	do.	2347	50.8 ± 4.07
- -	Petroleum oil (P4b) 5.0%	do.	2009	35.4 ± 8.92
- -	Lauryl rhodanate 0.2%	do.	2094	4.8 ± 1.63
- -	Tar oil (T.11) 2.0%	do.	2621	2.7 ± 0.87
- -	Tar oil (T.11) 1.5%	do.	2990	10.7 ± 2.32
- -	Benzene 2.5%	do.	1934	79.5 ± 3.37
- -	Nil	Nil	3481	96.1 ± 1.49

ACKNOWLEDGMENTS.

Our thanks are due to Mr. A. Wilkins for his patient and careful assistance and to Imperial Chemical Industries Ltd. for the provision of samples of the organic rhodanates.

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NOTE: Lauryl Rhodanate is manufactured by the Grasselli Chemicals Department, E. I. du Pont de Nemours & Company, and sold under the trade name "Loro." "Loro" is a registered trade name.

THE USE OF AGRICULTURAL PRODUCTS FOR LACTIC ACID MAKING OFFERS GROWERS A NEW MARKET IN THIS FIELD

EDITOR'S NOTE:- Since it is the policy of this publication to report trends as well as accomplishments in the field of agricultural research, including research that aims to find new uses for farm commodities, space is given gladly to this article. Such discussions emphasize the interdependence of the farm and the chemical products manufactory.

During the past few years the manufacture of chemicals directly from agricultural products has been increasing at a very favorable rate. Among the chemical products of great industrial importance made directly from agricultural materials is lactic acid. Starting with a laboratory observation by bacteriologists that sugars and other materials were acted upon by bacteria to produce a number of organic acids, it was not long before acid could be obtained in this way which contained a pre-dominatingly large quantity of lactic acid. With the increase in importance generally of industrial organic chemistry and in the use of organic products, the world and the United States production and consumption of lactic acid has increased markedly during the past decade. This increased production of lactic acid has resulted in the additional useful consumption of either pure farm or agricultural products or the use of agricultural products or agricultural wastes for which there had been no previous appreciable economic outlet.

Lactic acid until a few years ago and, actually at the present time, has been made largely from cane sugar, beet sugar, starches of various kinds, crude cane syrup and molasses of various grades. During the past few years, the United States Department of Agriculture has worked in its laboratories on the development of a process for the manufacture of lactic acid from dairy products, particularly from the whey obtained from milk.

Increase in Number of Uses

The uses of lactic acid are legion. This acid is superior in many respects and in many instances to other more usual organic acids, such as the natural agricultural products like vinegar and also such synthetic organic acids as acetic, citric, tartaric and the like. Not only has lactic acid displaced a number of these acids in industrial processes, but the applications of lactic acid to new fields have increased at a very appreciable rate.

The quality of each of the various grades of lactic acid manufactured in the United States has increased markedly during the past few years. A few years ago, the United States requirements for the U.S.P. grade of lactic acid were imported entirely. At the present time, the requirements of this high-grade lactic acid are made in the United States.

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The importance of the present large outlets of lactic acid and the future possible increased use of this acid are very important to the American agricultural interests. The farmer, therefore, in all those sections of the United States which produce any of the crude materials mentioned above, that are used for the production of lactic acid, will therefore benefit from the present production and uses of this product. The greatly increased uses which would appear to be probable for the future will reflect increased credit and benefit to the United States farmer.

NOTE: The Grasselli Chemical Department, E. I. du Pont de Nemours & Company, Cleveland, Ohio, is an important producer of lactic acid.

THE TREATMENT OF VEGETABLE SEED BY SEEDSMEN IS BECOMING A PRACTICE IN CERTAIN SECTIONS

EDITOR'S NOTE:- There was printed in the October number of this publication a part of an address by Dr. Haskell before the Annual Convention of the American Seed Trade Association, Dallas, Texas. The second, and concluding, portion of this interesting discussion appears below.

By R. J. Haskell,
Extension Plant Pathologist,
Extension Service,
U. S. Department of Agriculture.

For several years delinting of cotton seed has been practiced, particularly in western areas, for the control of angular leaf spot and for agronomic reasons. Of late years treatment with organic mercury dust has supplanted it to a considerable extent but in some cases has been super-imposed on the delinted seed. The year 1935 saw an increase in treatment in the eastern cotton States. Many demonstrations showed a greatly improved stand from the use of the dust.

The Pee Dee Station at Florence, South Carolina, is getting its seventh year of data on seed treatment this year. Their five years' average results from 1930 to 1934, show an increase of 141 pounds of seed cotton per acre. A South Carolina seedsman reports an increase of 228 pounds of cotton on treated acres in 1935. This spring cotton seed treatment has jumped ahead again. The seed in much of the Carolinas and Georgia was diseased, weak, and of low vitality. Seed treatment helped. Vigorous extension projects for seed testing and treating were organized in these States. Many demonstrations were put on. This last month I spent three days in the Carolinas looking over the results of some of that work. In some 30 fields from which we obtained counts we found an increase in stand of cotton plants before chopping of 157 percent--one and a half times as many plants in the treated rows as in the untreated.

Vegetable and Flower Seed Treatment Expanding

Coming now to vegetables and flowers we have a large number of seeds each with its own characteristics and sensitivity to chemicals and heat and each with its own set of seed-borne parasites.

In the case of tomatoes the mercuric chloride treatment 1-3000 for 5 minutes followed by rinsing in clear water is commonly recommended for the control of bacterial canker, Alternaria and other diseases.

For cabbage and other crucifers a hot water bath at a temperature of 122°F. for 25 minutes is recommended and used for control of black leg, black rot and Alternaria. If no black leg fungus is present corrosive sublimate 1-1000 for 30 minutes may be substituted.

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Celery and all cucurbits may be soaked in corrosive sublimate. Beans have plenty of seed-borne diseases but satisfactory treatment has not been worked out for them.

Within the last few years several new materials have been brought forward for treating vegetable and flower seed for the control of damping off, seed decay and seedling blight. Those that occupy the limelight at the present time are organic mercury, red oxide of copper and zinc oxide. All are used in the form of a dust. Very striking increases in stands and yields of vegetables and flowers have been obtained at Experiment Stations in New York, Ohio and Virginia by the use of these dusts. In New York the treatment of Surprise peas with red oxide of copper last year gave a 30 percent increase in stand of plants. In Virginia in 1934 the use of any of the above three chemicals increased the stand of early fall sown spinach all the way from 200 to 600 percent. In New York the effect of red copper oxide on 107 kinds of plants was studied and some very striking differences in favor of the treatment were obtained.

Seedsmen are Beginning to Take up the Treatment of Vegetable Seed

The large cooperative operating in New England treated most of its vegetable seed last year. Each seed had its own particular treatment. I had the pleasure of visiting the warehouse where the treatment was accomplished and found a well-equipped laboratory with mixers for applying the dusts, baths for soaking the seed and an efficient drying apparatus for drying the seeds that had been wet. Conversation with the manager led to the conclusion that the treatments are working out very well and have become a standard practice.

Another instance that I might cite is that of a member of this Association operating in Florida. They found, with the assistance of the Florida Agricultural Experiment Station, that treatment with red copper oxide greatly improved the stand of lima beans in certain parts of the State. Many failures were reported until all local branches in that area started treating the seed before sale.

The admission of treated seed to the mails has recently given an impetus to this treatment by seedsmen.

Those of you from New York know that many seedsmen there are now treating their cabbage seed with hot water. Nearly 80 percent of the tons of cabbage seed used in New York last year was hot water treated. Some 2,100 pounds of copper oxide were used in this same State last year.

Other seed companies while not actually treating seed are handling the materials, giving directions for treatment in their catalogues and advertising and otherwise promoting the practice.

What are the advantages and disadvantages of seed treatment by seedsmen?

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First the disadvantages:-

1. Additional expense it is true. The chemical will cost you a few cents per bushel of seed treated and a certain amount of equipment ranging all the way from a small rotary barrel mixer to a large capacity automatic treater will be needed. Some additional labor will be required. If a wet treatment is given you should have artificial drying equipment. Additional labeling of packages to indicate treatment will be necessary.

2. The possibility of injuring seed by the treatment is something that must be watched. If the work is done carefully, with germination tests and correct dosages there should be no trouble. The length of time the treated seed is stored following treatment has to be considered also as there is a tendency with some treatments to slightly lower germination during the longer storage periods.

3. Then there is the possibility of discomfort to employees handling the treated seed. However, this can largely be done away with by having the proper exhaust ventilation facilities for removing surplus dust.

4. A fourth disadvantage is that treated seed such as cereals should not be diverted for human or animal consumption. It is my understanding that if a carload of grain appears on the market that has a noticeable odor of organic mercury dust it will be graded "Sample Grade--unfit for human consumption." There should not be much trouble about this however from the seedsmen's standpoint.

5. There is a possibility of some consumer resistance to treated seed but the public is fast becoming aware of the desirability of treatment and a slight color or odor of disinfectant should create a favorable rather than unfavorable impression in most cases.

Now with regard to the advantages - I think they greatly offset the disadvantages.

1. It gets the treatment done and saves crops. We extension people who have been recommending seed treatment to farmers and growers for many years know how hard it is to get people to take the time, bother and the additional expense at a busy time of year to treat their seed. They will take a chance and not do it although they know they should. Treatment by you may be the difference between treatment and no treatment at all.

2. Treatment can be performed more efficiently and more economically at the source. In the seed house the work can be carefully supervised, and a good job done at a minimum of cost. It is the logical place to do it.

3. Treatment at the source may prevent the spread of new or dangerous diseases.

4. There is a possibility, sometime in the future of decreasing the loss in viability or at least maintaining germination by means of seed treatment.

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5. Treatment will make for satisfied customers. They will appreciate the treating service and there will be fewer complaints of poor results and diseased crops. This will make for good will and increased business and even if your firm does not net any profit on the treatment itself, this increased good will will pay for it many times.

Before closing I want to say again that there is still much to be learned about seed treatment. We have not begun to reach perfection by any means. We need more experiments using various methods in many places and under different conditions. The experimenters will need your cooperation and support. The wind is blowing strongly toward seed treatment at the source and as time goes on more and more of you will set your courses in that direction. The channel has recently been opened by research but there are remaining sandbars and reefs. These however can and will be cleared away and charted by further investigations, experience and cooperative effort.

PONDS MUST HAVE DEPTH TO WITHSTAND DROUGHT
U. S. DEPARTMENT OF AGRICULTURE POINTS OUT

EDITOR'S NOTE:- Preparedness for future droughts is a subject in which farmers, agricultural engineers, and county agents are keenly interested. Therefore, this article on making ponds for the storing of water is well worth perusal by all concerned.

By L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.

Recently, the United States Department of Agriculture made a statement as follows:

"It's capacity of a pond that counts, and depth is an important part of capacity that often has been overlooked.

"During the 5 months, May-September, 200 head of cattle will drink nearly an acre-foot of water-325,850 gallons-at the rate of about 10 gallons of water for each animal daily. The Department of Agriculture has found that in the Great Plains in this same period four to five times as much water may be evaporated from a reservoir.

"In constructing reservoirs or ponds for livestock, a depth of double a season's evaporation loss is a safe rule, says the Soil Conservation Service.

"From April through September average evaporation from ponds in the Great Plains runs from 5 feet in western Texas to a little less than three feet in the Dakotas and Montana, according to 15 to 30 years of records kept by the Division of Dry Land Agriculture. In the dry summer of 1934, evaporation losses reached nearly 6 feet in southwestern Kansas. Figures for the drought summer of 1936 have not been completed, but they will be much above the average.

"Evaporation losses in 1934 showed these increases over the 15-year average: 20 inches at Hays, Kans.; 16 inches at North Platte, Nebr.; 15 inches at both Colby and Garden City, Kans.; 12 inches at Dickinson, N. Dak.; 14 inches at Lawton, Okla.; 13 inches at Dalhart, Tex.; 12 inches at Tucumcari, N. Mex., and lesser increases at other points in the drought areas.

"Evaporation losses may be reduced by locating stock ponds and reservoirs, if possible, so they will be protected from hot, drying winds by steep slopes or trees. But the greatest saving of water is made with a pond of minimum area and maximum depth. Record of southwestern reservoirs show those more than 12 feet deep go dry much less frequently than those shallower."

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Blasting Deep Ponds With Dynamite

Many factors are involved in the efficient and economical blasting of ponds. Naturally, the "work" that a given quantity of dynamite will do depends upon such things as the character and the condition of the soil.

There are records of numerous pond-blasting operations in which ponds of varying sizes up to 100 feet wide have been excavated, but the very large ponds require ideal conditions. Ponds up to 40 feet wide can be shot economically and easily in wet soil. Such ponds can be of adequate depth, as recommended by the U. S. Department of Agriculture for insuring an ample supply of water during periods of drought.

While there are several methods of blasting that may be employed in blasting ponds, the generally accepted practice is known as the post-hole method. It takes its name from the fact that usually holes are put down in much the same manner as those for farm fence posts -- with a post-hole auger. The need for a hole of large diameter arises from the fact that in post-hole blasting the load of dynamite is made up of a bundle of cartridges. This load is placed one-half to two-thirds the required depth of the pond in a single line of holes. This method of blasting usually gives a pond with a bottom width equal to the depth and a top width equal to three times the depth. For deep ponds, experience shows that these large charges spaced at the proper distance apart, and fired either by electricity or propagation, will throw out a greater yardage material than will an equal total poundage of dynamite, with a smaller quantity of the explosive divided among a number of holes and column-loaded in holes spaced closer together than is the practice for post-hole loading.

Specifications for Post-hole Loading.

Ponds can be made any length desired. All that is necessary for giving length to a pond of any other dimension is to increase the number of holes.

Below is a table which will serve as a good starting point in determining the quantity of dynamite and other factors to consider in pond blasting. But a test shot is always advised before loading a large number of holes.

The quantity of dynamite to be placed in each hole for a test shot can be determined by the cubic yards of material that each hole is expected to remove. The basis of calculation is one cubic yard per pound of du Pont Ditching Dynamite.

Number of sticks per hole	30	50	100
Number of pounds per hole	15	25	50
Distance between holes-feet	4½	5	6
Depth of ditch-feet	7	8½	12
Bottom width of ditch-feet	7	8½	12
Top width of ditch-feet	21	25½	36
Depth of load hole-feet	5	6½	9
Diameter of Post Hole-inches	6	8	8
Dynamite per rod-pounds	54¾	82½	138

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Dynamite per 100 feet-pounds	333	500	833
Materials moved per rod-cu. yds.	60	88	176
Materials moved per 100 feet-cu. yds.	363	533	1067

NOTE: Cartridges, or sticks, are 1¼" x 8"

Post-holes, like all other loaded holes, must be properly tamped. Where there is enough water in the ground to fill the hole after it is loaded, no other tamping is required. In any other case, the hole above the load should be filled with earth and firmly tamped. A wooden tool must be used to avoid the possibility of a premature explosion from a spark caused by metal in contact with anything hard in the soil.

Blasters should inform themselves, if they do not already know, on blasting by propagation or the electrical method; whichever is to be used.

Know and follow all safety rules for the handling and use of dynamite in pond blasting.

NOTE: Mr. Livingston will be glad to supply any information desired on pond blasting or other agricultural uses of dynamite. This service is without charge.

LOCAL STUDIES OF FACTORS AFFECTING WILD GAME NEEDED ACCORDING TO REPORT TO AMERICAN WILDLIFE INSTITUTE

EDITOR'S NOTE:- Authorities are now agreed that the problem of increase in numbers of useful species of wildlife is a local one and can not be solved on any other basis. This sound view has been adopted by the American Wildlife Institute, Investment Building, Washington, D. C., as will be seen from the article below.

Local studies of the factors which make for the increase or decrease of nine important species of farm, forest and range game will be required before any intelligent national program for conserving them can be adopted, the Technical Committee of the American Wildlife Institute has informed the trustees of the Institute, in a recent report. It named the species as the western quails, bobwhite, grouse, wild turkeys, pheasant and Hungarian partridge, cottontail, deer and antelope.

The Committee, headed by Dr. Aldo Leopold, professor of game management of the University of Wisconsin, is recommending a study of these nine species to the Trustees for Institute financing, at least in part.

Of the need to study these species, the Technical Committee says: "Excellent life history work on California and gambel quails needs to be tested in practice. Studies of scaled quail need to be executed. It will be of great value to know in detail just how livestock limits the productivity of quail range."

"Studies of the bobwhite, begun in Georgia, Wisconsin and Iowa, the Committee said, are disclosing fundamental laws applicable to all gallinaceous birds, but the degeneration of the bobwhite in New England has never been explained."

The fact that Civilian Conservation Corps companies are now altering the cover of large amounts of land where grouse would naturally range, and that a great deal more of such land is coming into public ownership means that studies of grouse conservation need to be started as quickly as possible, the Committee reports. No study ever has been made, it says, of the western grouse.

Problems for Investigation

The Committee notes with gratification that some progress is being made in research concerning the proper environment for wild turkeys on private game preserves in the Southeast. It observes, however, that no study ever has been made of the Southwestern or Merriam turkeys. The Committee asks that studies be made of the recession of population vigor among the pheasants and Hungarian of Oregon and New England.

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"A similar decline might well occur in the now thrifty stands of South Dakota, Minnesota and Iowa," the report says. "The general failure of ringneck pheasants and Hungarian partridges in the South is still a mystery."

As for research into ways to save the country's deer and antelope, the Committee says: "Browse eating game ruins its own range, while seed eating game does not. All over the country valuable spots of deer range are now threatened with grave injury to both range and deer. These trouble spots are worse where no predators remain to keep the herd in balance with the carrying capacity of the range. Intelligent adjustment demands a local knowledge of food habits and this so far exists only in a few states."

Of the antelope, the Committee says: "We still are unable to explain why a few antelope remnants have continued to increase until they destroy the carrying capacity of their range, while others dwindle until they disappear."

Besides Dr. Leopold, the Committee is composed of Gardiner Bump, Superintendent of Game, New York Conservation Department; George C. Embody, Professor of Fish Culture, Cornell University; Carl L. Hubbs, Director, Institute of Fisheries Research, University of Michigan; and Herbert L. Stoddard, Cooperative Quail Study Association. Their report is to be the basis for a research program financed by the American Wildlife Institute.

THE DEPARTMENT OF FORESTRY AND FISH AND GAME OF MEXICO PUBLISHES VALUABLE DATA IN BULLETIN

We are pleased to call attention to the valuable studies made public recently in the Boletin del Departamento Forestal y de Caza y Pesca, (Bulletin of the Department of Forestry and Fish and Game) of Mexico, presented by the Chief of that department, Ing. Miguel A. de Quevedo. To all those interested in forest preservation and the actual condition of fish and game, this volume offers valuable data. It consists of 350 pages and is an interesting review of the studies made in certain lines of activity of this department.

It gives an account of the recent investigations of lakes and rivers in the states of Morelos and Guerrero. It discusses certain aspects of reforestation and fish conservation. It reviews forest cooperatives. It gives information on the stocking of fish in interior waters. These and other subjects are dealt with in an interesting fashion.

At the recent Wild Life Conference, held in Washington, D. C., early in 1936, it was interesting to note the number of visitors to that Conference who remarked on the reports of the good work being done in Mexico along the lines of conservation of forests and of game. This conference was attended by His Excellency, the Ambassador of Mexico and by Ing. Miguel A. de Quevedo, head of the department of forestry, fish and game of the Government of Mexico.

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